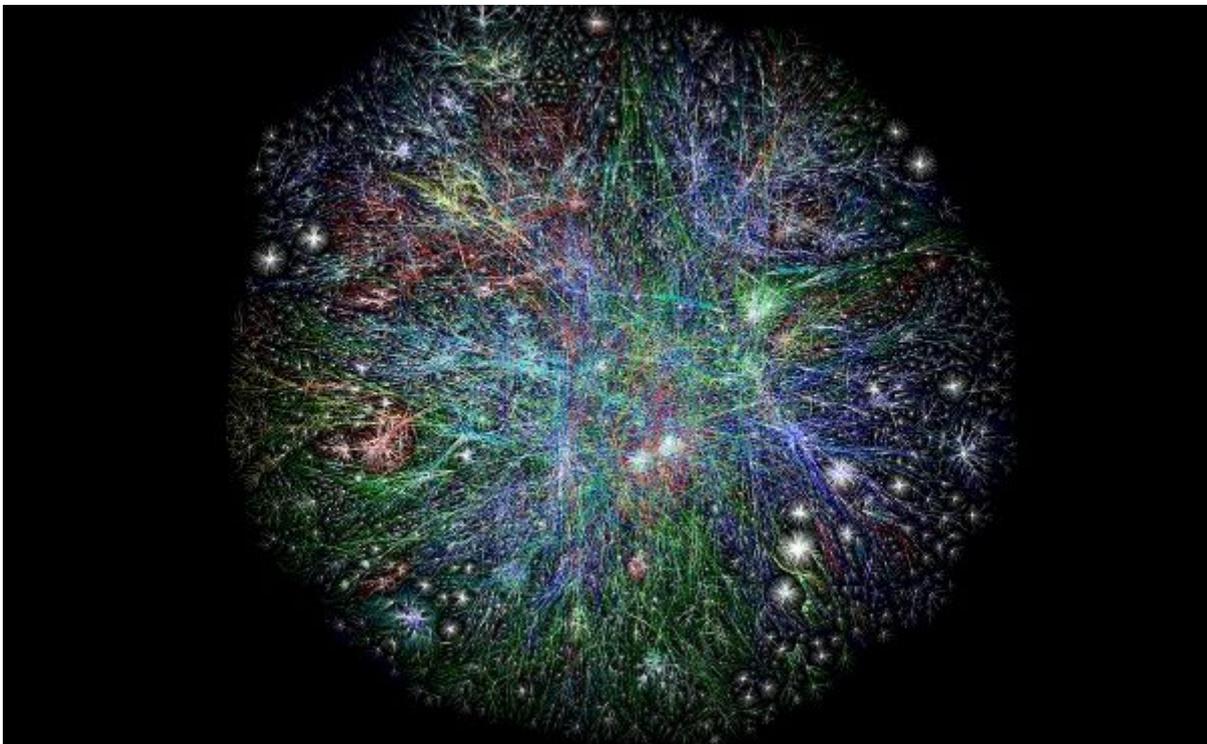


*In an era where bureaucracy is the biggest burden bestowed upon scientists, some are seeking practical solutions. Inspired by the science of complexity, new ways of harnessing the wisdom of the scientific community are emerging. This leads to new decision-making mechanisms to allocate the limited amount of resources, which is bypassing the biggest plague affecting the research endeavour. Euroscientist investigates out-of-the-box solutions to this bureaucratic conundrum.*



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## **Self-organised scientific crowds to remedy research bureaucracy**



### **Twinking scientists' social mechanisms may significantly alter the scientific endeavour**

Imagine a world without peer review committees, project proposals or activity reports. Imagine a world where research funds seamlessly flow where they are best employed, like nutrients in a food-web or materials in a river network. Many scientists would immediately sign up to live in such a world.

The Netherlands is set to become the place where this academic paradise will be tested, in the next few years. In July 2016, the Dutch parliament [approved](#) a motion related to implementing alternative funding procedures to alleviate the bureaucracy, which is increasingly burdening scientists. Here

[EuroScientist](#) investigates whether the self-organisation power of the scientific community could help resolve one of researchers' worse burden.

## Self-organisation

The Dutch national funding agency is planning to adopt a radically new system to allocate part of its funding, promoted by ecologist [Marten Sheffer](#), who is professor of aquatic ecology and water quality management at Wageningen University and Research Centre. Under the proposed approach, funds would initially be evenly divided among all scientists in the country. Then, they would each have to allocate half of what they have received to the person who, in their opinion, is the most deserving scientist in their network. Then, the process would be iterated.

The promoters of the system believe that the "wisdom of the crowd" of the scientific community would assign more funds to the most deserving scientists among them; with minimal amount of paperwork. The Dutch initiative is part of a [broader effort](#) to use a scientific approach to improve science.

In other words, it is part of a trend aiming to employ scientific evidence to tweak the social mechanisms of academia. Specifically, findings from what is known as [complexity research](#) are [increasingly brought forward](#) as a way of reducing bureaucracy, removing red tape, and maximising the time scientists spend in thinking.

## Collaborative social endeavour

One element of the world of complexity that is missing from the way resources are currently allocated relates to the community-based dynamic of research. "Funding agencies are run by well-intentioned people. But they apply a 20th century contractor model; you want to refurbish your kitchen and you choose the best proposal," says Johan Bollen, a computational social scientist of Indiana University, IN, USA, who [originally conceived](#) the idea promoted by Sheffer. Unfortunately, he adds: "basic science does not work like this."

Instead, "science has transformed into a much more collaborative endeavour, rather than a competitive one," he notes, "The current system does not leverage the fact that science is a social network."

In devising his solution, Bollen took inspiration from Google's approach to networks. When a new website is created, it does not need to submit a proposal processed by a committee before the search engine can rank it. Google uses an algorithm ranking at higher level the websites with a more salient position in the way they are inter-related to other sites on the web. "Why don't we use the network of science to calculate who are the most productive scientists and give them the funds?" asks Bollen. He points out: "In our system, scientists themselves distribute money along the network."

## An outdated system

So what has made science bureaucracy become so out-dated? "We are working with methods conceived for the world of the 60s and the 70s," says Bollen. He adds: "Scientists are estimated to spend as much as 30% of their time writing proposals." Others are even more pessimistic. "After teaching and paperwork, science is happening in the evenings and weekends, like a hobby," says Dirk Helbing, professor of computational social science at ETH Zürich, Switzerland, who has been an advocate for "re-inventing innovation."

However, there is much more at stake than scientists' spare time. "There hasn't been any great innovations since Darwin's theory of evolution and Einstein's theory of relativity," [writes Helbing](#) in his Future ICT blog. He adds: "Science is increasingly [run like a business](#), measured by performance indicators." He also points out: While we perform better and better according to these indicators [...] the problems our society is facing haven't been fixed."

## **New forms of assesement**

Performing measurement for the sake of it does not make sense. "When measures become a target, they stop being measures," says Dave Snowden, founder and chief scientific officer at knowledge management company [Cognitive Edge](#), "Now, they don't measure anymore: they enforce orthodoxy. Novelty is very difficult."

Instead, "a real understanding of science requires science to be applied to it: we would need good computational models of bureaucratic processes like control, guiding, etc. But it's still early days" says [Bruce Edmonds](#), director at the Centre for Policy Modelling at Manchester Metropolitan University, UK, who specialises in agent-based simulations of the scientific processes.

Beyond evaluation and funding, complexity science may help reducing science bureaucracy in other ways. For example, by tracking real interactions between scientists, beyond the formal barriers of departments and hierarchies. [Albert Díaz Guilera](#), professor of statistical physics at the University of Barcelona, [compared](#) the formal organisation chart of his university with the map of interactions between scientists as tracked by the volume of their email exchanges. "The formal network is like a skeleton, but the informal one is like a circulatory system," he explains. This information, he believes, can be used to reorganise academic structures, to adapt to the informal ones and also to detect missing links and bottlenecks in the communication with an institution.

## **Peer review: fix it or leave it?**

Abandoning the current bureaucratic, top-down system to evaluate and fund research, based on labour-intensive peer-review, may not be too much of a loss. "Peer-review is an imperfect, fragile mechanism. Our [simulations](#) show that assigning funds at random would not distort too much the results of the traditional mechanism," says Flaminio Squazzoni, an economist at the University of Brescia, Italy, and the coordinator of the [PEERE-New Frontiers of Peer Review](#) COST action.

In reality peer-review is never quite neutral. "If scientists behave perfectly, then peer review works," Squazzoni explains, "but if strategic motivations are taken into account, like saving time or competition, then the results are worse than random." Squazzoni believes that automation, economic incentives, or the creation of professional reviewers may improve the situation.

Helbing calls for an even more radical change in the philosophy of funding. "Since great ideas cannot be identified beforehand, we should shift from funding proposals to refunding great ideas," he proposes. Scientists would get a starting capital without the need for filing proposal and after some time the funds would be increased or decreased depending on their success, without the need for writing reports. Helbing admits, however, that identifying great ideas would be still an open problem.

In fact, even the promoters of applying complexity to reducing bureaucracy recognise that change is not straightforward. "Making the rules more open ended [...] can create a more fluid system that can adapt as the environment shifts," says Jessica Flack, head of the collective computation group at the Sante Fe Institute, New Mexico, USA. She concludes: "It also, of course, makes for a more cheatable system so the rules that are relaxed should be those rules that do not have critical consequences or costs if violated." No system is perfect!

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